

**System and Method for Device-Based
Access Privilege to an Account**

BACKGROUND OF THE INVENTION

1. Technical Field

5 The present invention relates in general to a system and method for providing device-based access to an account. More particularly, the present invention relates to a system and method for providing access to online financial transactions based upon the protocol supported by the
10 user's device.

2. Description of the Related Art

Modern computing devices range from large super computers to small handheld devices, such as personal digital assistants (PDAs) and mobile telephones. Users are
15 increasingly using a variety of computing devices to request and retrieve information from servers by using computer networks, such as the Internet.

Devices support different protocols based upon the devices capabilities. A protocol is an agreed-upon format
20 for transmitting data between two devices. The protocol determines the type of error checking that is used, the type of data compression (if any) that is used, how the sending device indicates that it is finished sending a message, and how the receiving device acknowledges receipt
25 of a message. Each protocol has particular advantages and disadvantages. For example, some are easier to use than others, some are more secure than others, some are faster than others, and some are more reliable than others.

One computing device may support a particular protocol and not support another protocol. Users connecting to a website of a financial institution may wish to connect using a variety of devices that support a variety of 5 protocols. One of these protocols is the Wireless Access Protocol (WAP), which is a secure specification that allows users to access information using wireless, usually handheld devices such as mobile phones, pagers, two-way radios, smartphones, communicators, and PDAs. Another 10 protocol is the HyperText Transfer Protocol (HTTP) which is an underlying protocol used by the World Wide Web (WWW). HTTP defines how messages are formatted and transmitted and what actions Web servers and browsers should perform in response to various commands. An extension of the HTTP 15 protocol, called "S-HTTP" uses encryption to provide secure messages between a computing devices, such as a client and a server. A challenge, however, is that not all browsers and computing devices support the secure version of HTTP. Another technology used for securely transmitting messages 20 is Secure Socket Layer (SSL) which establishes a secure connection using encryption between two computers. While both use encryption to secure messages, SSL and S-HTTP have different designs and goals. By convention, the address or "Uniform Resource Locator" (URL) of a Web page that require 25 an SSL connection start with "https" rather than "http."

A challenge of providing financial information is that much of the information is confidential, or sensitive, so secure connections (i.e., SSL) are often required in order for a user to view his or her account stored on the 30 financial institution's server. This requirement, however, conflicts with the desire of many users to view financial

information using portable devices, such as PDAs and mobile phones, that have browsers that do not support the type of secure connections provided using SSL. In addition, financial information has degrees of sensitivity depending on what the user wants to do with the information. For example, simply checking an account overview (i.e., account balances), may not be seen by the user as being as sensitive as transferring money to other accounts or using online bill paying services where an account balance is actually changed.

What is needed, therefore, is a system and method for allowing the user to access his or her financial information from a variety of devices. What is further needed is a system and method that permits access to financial functions based on the sensitivity of the functions. Finally, what is needed is a system and method that allows a user to choose which functions can be performed when the user is connected to the financial institution's servers using a variety of protocols corresponding to a variety of communication devices and the additional ability of optionally "registering" network addresses of the user's devices.

SUMMARY

It has been discovered that the aforementioned challenges are resolved using a system and method that provides device-based access to account functions based upon one or more protocols supported by the device. For example, if the user is using a device that communicates with a more secure protocol, such as secure HyperText Transfer Protocol (HTTPS), then more sensitive account functions, such as making online payments and transferring funds may be allowed. However, if the user's device is using a less secure protocol, such as Wireless Access Protocol (WAP) or HyperText Transfer Protocol (HTTP), then less sensitive account functions might be provided, such as checking account summaries or balances, while not allowing access to more sensitive account functions, such as making online payments and transferring funds. In this manner, the user is not entirely restricted from accessing his or her account simply because of the protocol supported by the user's device.

In one embodiment, the user establishes security settings that determine whether the user is allowed to perform a particular account function based on the type of protocol being used. The user can choose between the convenience of accessing account functions and possible security risks involved with using less secure protocols. In addition, the user can alter the security settings temporarily and then reset the security settings to their previous values. For example, suppose a user typically accesses his account from a desktop computer using a browser that supports the HTTPS protocol, however the user

is going on vacation for a week and does not wish to bring a portable computer on the trip. The user can temporarily alter his security settings and allow account functions, such as bill payment functions and funds transfer 5 functions, to be performed when using devices that use the WAP protocol, such as a mobile telephone or wireless Personal Digital Assistant (PDA). In this manner, the user can still access these functions while on vacation. Following the vacation, the user is able to reset the 10 security settings to only allow the funds transfer and online payment functions from devices that support the HTTPS protocol.

A further embodiment provides for the registration of network addresses, such as IP addresses, corresponding to 15 the user's devices. Devices using a registered IP address can be treated differently because the connection is less prone to hackers or other unauthorized people accessing the account.

The foregoing is a summary and thus contains, by 20 necessity, simplifications, generalizations, and omissions of detail; consequently, those skilled in the art will appreciate that the summary is illustrative only and is not intended to be in any way limiting. Other aspects, inventive features, and advantages of the present 25 invention, as defined solely by the claims, will become apparent in the non-limiting detailed description set forth below.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention may be better understood, and its numerous objects, features, and advantages made apparent to those skilled in the art by referencing the 5 accompanying drawings. The use of the same reference symbols in different drawings indicates similar or identical items.

10 **Figure 1** is a network diagram showing a user accessing a financial institution's server using two different devices and protocols;

Figure 2 is a flowchart showing the steps taken to establish a session between a user's device and the financial institution's server;

15 **Figure 3** is a flowchart showing the steps taken to retrieve the allowed actions corresponding to the protocol being used by the user's device and whether the network address of the device has been pre-registered by the user;

Figure 4 is a flowchart showing the steps taken to process a user's request;

20 **Figure 5** is a flowchart showing steps taken to change a user's security settings;

Figure 6 is a screen layout showing security settings that can be selected by a user;

25 **Figure 7A** is a sample screen showing the user-selected actions that are available when the user is accessing the financial institution's server using a device that communicates using a secure protocol;

Figure 7B is a sample screen showing the user-selected actions that are available when the user is accessing the financial institution's server using a device that communicates using a non-secure protocol;

5 **Figure 8** is a flowchart showing the steps taken to process financial actions requested by the user; and

Figure 9 is a block diagram of an information handling system capable of implementing the present invention.

DETAILED DESCRIPTION

The following is intended to provide a detailed description of an example of the invention and should not be taken to be limiting of the invention itself. Rather, 5 any number of variations may fall within the scope of the invention which is defined in the claims following the description.

Figure 1 is a network diagram showing a user accessing a financial institution's server using two different 10 devices and protocols. User 100 connects to financial institution server 150 using one or more devices, such as first device 110 and second device 125. Each of these devices uses a protocol and has a network address (115 and 130, respectively) for communicating with others over the 15 network. Examples of protocols include Wireless Access Protocol (WAP), HyperText Transfer Protocol (HTTP), and secure HyperText Transfer Protocol (HTTPS). The type of protocol used by a device depends on the capabilities of the device as well as network(s) 140 used. For example, a 20 mobile wireless device, such as a Personal Digital Assistant (PDA) or mobile telephone, typically uses the Wireless Access Protocol to communicate with other computing devices, while a desktop computer system typically uses the HyperText Transfer Protocol to access 25 other computer systems and may use a secure version of HTTP if the browser on the desktop computer system supports Secure Socket Layer (SSL) or other encryption scheme.

In Figure 1, user 100 sends request 120 using first device 110 with first protocol and network address 115 to

access financial institution server **150** through network(s) **140**. Financial institution server **150** receives and validates the user's request at step **155**. The server retrieves the user's security settings at step **160** from data store **165**. These security settings may be settings that the user established or default security settings established by the financial institution. In addition, security settings can be based on the protocol that is being used as well as whether the device's network address has been pre-registered at the financial institution and stored in security settings **165**.

At step **170**, the user's account information is retrieved from data store **175** based upon the retrieved security settings. For example, if the settings indicate that the user is not allowed to transfer funds or pay bills when the user's device is communicating with the financial institution using the WAP protocol, then account functions allowing the user to transfer funds and pay bills would not be enabled by the financial institution's server. Account information appropriate for the protocol being used by the user's device is returned to the user by the financial institution's server at step **180**. The user's device, in turn, receives account information **190** appropriate for the first device.

Similarly, when user **100** is using second device **125** to access the financial institution's server using a second protocol and network address **130**, the server receives and validates the request (step **155**) and retrieves the user's security settings (step **160**) from data store **165**. However, because the user is using a different protocol to access the server, different security settings may be retrieved

resulting in different account information being retrieved (step **170**) from data store **175** and returned to the user at **180**. For example, if the second device is a desktop computer system with a browser that supports SSL, the 5 security settings might allow the user to transfer funds and pay bills online. Therefore, the account information returned to the user would include account functions that were not permitted when the user was using first device **110**.

10 **Figure 2** is a flowchart showing the steps taken to establish a session between a user's device and the financial institution's server. Processing commences at **200** whereupon the financial institution's server receives the user's login identifier (i.e., user id) and password at 15 step **210** from user **220**. At step **225**, the financial institution's server authenticates the user by checking the login identifier and password with authentication data **230** that was previously stored on a nonvolatile storage device accessible from the financial institution's computer 20 system.

A determination is made as to whether the user information is authenticated (decision **235**). If the information is not authenticated (i.e., the login identifier, password, or combination thereof was not found 25 in authentication data **230**), decision **235** branches to "no" branch **238** whereupon an error is returned to the user at step **240** and processing ends at **245**.

On the other hand, if the user's login identifier and password were authenticated, decision **235** branches to "yes" 30 branch **248** whereupon the protocol and network address

(e.g., IP address) being used by the user's device is retrieved (step **250**). The account functions that are allowed based upon the protocol being used and whether the network address has been registered are retrieved from 5 security settings data store **270** (predefined process **260**, see **Figure 3** and corresponding text for processing details).

The allowed account functions are listed or displayed on the user's device at step **275**. If the user is using a 10 device with a display screen, the allowed activities are displayed on the device's display screen and the user selects an account function by selecting a displayed action (i.e., by using a pointing device or keyboard to select). If the user is using a device, such as a telephone, with 15 little or no display capabilities, the list of account functions is audibly played to the user and the user makes a selection by pressing a key on the telephone keypad. At step **280**, the financial institution's server receives the user's request and the request is processed (predefined 20 process **290**, see **Figure 4** and corresponding text for processing details). Processing thereafter ends at **295**.

Figure 3 is a flowchart showing the steps taken to retrieve the allowed account functions corresponding to the protocol being used by the user's device. Processing 25 commences at **300** whereupon, at step **310**, the financial institution's computer system determines the protocol being used by the user's computing device to access the financial institution's computer as well as the network address being used by the user's computing device (e.g., the IP address). 30 A determination is made as to whether the network address being used by the user's device has been registered at the

financial institution (decision **320**). If the network address has been registered, decision **320** branches to "yes" branch **325** whereupon, at step **330**, the account functions allowed for a registered address using the given protocol (e.g., HTTPS, HTTP, WAP, etc.) are retrieved from security settings data store **350**.

On the other hand, if the network address being used by the user's device has not been registered, then decision **320** branches to "no" branch **335** whereupon, at step **340**, the account functions allowed for an unregistered address using the given protocol are retrieved from security settings data store **350**.

After the list of any allowed account functions has been retrieved based upon the protocol being used by the user's device and whether the network address of the user's device is registered, a determination is made as to whether there are any allowed account functions that the user can perform given the protocol and address being used (decision **370**). If there are no allowed account functions for the protocol and address, decision **370** branches to "no" branch **375** whereupon, at step **380**, the financial institution's server ceases communication with the device and does not allow the device to perform any actions. On the other hand, if there is at least one allowed account function corresponding to the protocol and address, decision **370** branches to "yes" branch **390** bypassing step **380**. Processing then returns to the calling routine at **395**.

Figure 4 is a flowchart showing the steps taken to process a user's request. Processing commences at **400** whereupon a determination is made as to whether the user is

requesting to sign off of the financial institution's Web server (decision **410**). If the user is not requesting to sign off, decision **410** branches to "no" branch **415** whereupon another determination is made as to whether the account function being requested is allowed given the protocol being used by the user's device (decision **420**). If the account function being requested is not allowed given the protocol being used by the user's device, decision **420** branches to "no" branch **425** whereupon, at step **430**, an error is returned to the user informing the user that the request is not allowed. In another embodiment, the user is only provided with a list of allowable actions from which to select. However, hackers and other malevolent users may attempt to use a non-secure protocol to request account functions that are not allowed based on the protocol. Therefore, checking whether the account function being requested is allowed given the protocol is nonetheless helpful in thwarting efforts by hackers or other malevolent users that may attempt to log onto another user's account to illegally withdraw funds or transfer money.

If the account function being requested is allowed given the protocol being used, decision **420** branches to "yes" branch **435** whereupon a determination is made as to whether the request is to change the user's security settings (decision **440**). If the request is to change security settings, decision **440** branches to "yes" branch **445** whereupon a routine is performed to change the user's security settings (predefined process **450**, see **Figure 5** and corresponding text for processing details). On the other hand, if the request is to perform an account function

other than change security settings, decision **440** branches to "no" branch **455** whereupon the other account function is performed (predefined process **460**, see **Figure 8** and corresponding text for processing details).

5 The next request is received from the user at step **475** and processing loops back to process the next received request. This looping continues until the user requests to sign off of the financial institution's web server, at which point decision **410** branches to "yes" branch **490** and
10 processing ends at **495**.

15 **Figure 5** is a flowchart showing steps taken to change a user's security settings. Processing commences at **500** whereupon, at step **510**, the user's current security settings are retrieved from security settings data store **570**. If the user has not previously established security settings, then default security settings established by the financial institution are retrieved.

20 At step **520**, the retrieved security settings are displayed in window (predefined process **575**, see **Figure 6** and corresponding text for details of the displayed user interface window).

25 At step **525**, the user selects and changes a security setting, enabling or disabling access to an account function when operating using a particular protocol. A determination is made as to whether the user wishes to make more changes to his or her security settings (decision **530**). If more changes are desired, decision **530** branches to "yes" branch **532** which loops back to receive the next selection and change from the user. This looping continues

until there are no more changes, at which point decision **530** branches to "no" branch **535**.

A determination is made as to whether the user wishes to save the changes made to the security settings or cancel such changes (decision **540**). The user indicates this decision by selecting either "save" or "cancel." (See "save" command button **680** and "cancel" command button **690** in **Figure 6**). If the user chose to save the changes, decision **540** branches to "yes" branch **545** whereupon, at step **550**, the user's security settings are saved to security settings data store **570**. On the other hand, if the user chose to cancel (i.e., not save the changes), decision **540** branches to "no" branch **565** bypassing step **550**. Processing of the user's security settings changes thereafter ends at **595**.

Figure 6 is a screen layout showing security settings that can be selected by a user. User interface window **600** is divided into three frames. Frame **610** includes "banking account functions" security selections that the user can select to indicate which banking account functions he or she wishes to be made available when the user is using a device with a corresponding protocol from a registered or unregistered address. Frame **620** includes "brokerage account functions" security selections that the user can select to indicate which brokerage account functions he or she wishes to be made available when the user is using a device with a corresponding protocol from a registered or unregistered address. Finally, frame **630** is used by the user to add and remove registered addresses, such as IP addresses. When an address is registered it is arguably more secure than an address using the same protocol that is

not registered. For example, if a user has a static IP address that he or she uses to access the Internet from their desktop computer, then the user is more certain that a hacker or other malicious user is not attempting to 5 access the user's account.

Frames **610** and **620** within user interface window **600** include checkboxes that the user can check or uncheck depending upon whether the user wishes to allow access to various account functions using various protocols. In the 10 example shown, three protocols are supported by the financial institution - secure HTTP (HTTPS), HTTP, and WAP. Within each of these protocols, the user can select whether a given account function can be performed by any device using the given protocol, or can only be performed by a 15 device with a registered address (e.g., a registered IP address). In the example shown, the user has selected that each account function be made available when the user is using HTTPS from a registered address. When the user is using HTTPS from an unregistered address, all account 20 functions are available except the user cannot access his or her brokerage account history.

When the user is using a device communicating using the HTTP protocol from a registered address, the user is allowed to check balances, transfer money between accounts, 25 perform online banking functions, change his or her login ID and/or password, view account statements, request new accounts, access brokerage services, trade securities, receive brokerage account overviews, and receive brokerage trading histories. On the other hand, if the user is using 30 a device communicating using the HTTP protocol from an unregistered address, the user cannot perform online

banking functions, change login IDs / passwords, request new accounts, request brokerage services, trade securities, or receive account brokerage account histories, all of which are allowed if the user's address is registered.

- 5 If the user is using a device communicating using the WAP protocol from a registered address, the user can check banking account balances, transfer money between accounts, perform online banking functions, view statements, and receive account overviews of the user's brokerage account.
- 10 From an unregistered WAP address, the user can only check banking account balances and view account statements.

The user can select additional options or remove options that are currently selected for a given account function. For example, the user can check the checkbox

- 15 allowing the user to "request a new account" when using a device communicating with either HTTP and/or the WAP protocols. Likewise, the user could remove the check from the checkbox to online banking services when using an unregistered address and the HTTPS protocol. In this
- 20 manner, the user can temporarily grant or restrict access to certain account functions. For example, suppose the user normally performs brokerage account functions from his desktop computer using a registered address that uses the HTTPS protocol. If the user is going to be traveling, he
- 25 can temporarily allow access to needed brokerage account functions from a device, such as a mobile telephone, that uses the WAP protocol so that the user can still trade securities while traveling. For added security, the user can temporarily register the WAP address of his mobile
- 30 device, if a static address is available, and select the security settings accordingly. Upon return from traveling,

the user can reset the security settings so that brokerage account functions are no longer allowed from a device using the WAP protocol.

Frame **630** is used to register and de-register addresses, such as IP addresses, used by the user to access account functions. List box **640** includes the addresses that are currently registered. In the example shown, three addresses are currently registered. Command button **650** is used to add a new address to the registered address list.

10 To remove a registered address, the user selects the address and then selects remove address command button **660**.

After the user is finished making security selections and registering or removing registered addresses, he or she either selects "save" command button **680** to save the changes that were made and exit, or selects "cancel" command button **690** to cancel the changes that were made and exit.

Figure 7A is a sample screen showing the user-selected actions that are available when the user is accessing the financial institution's server using a device that communicates using a secure protocol from a registered IP address. When the user accesses his or her account using a device that communicates using the secure HTTP protocol after establishing the security settings shown in **Figure 6**, browser window **700** is displayed. Browser window **700** includes eight account functions, **705** through **735**, as well as brokerage services frame **740** which includes three possible brokerage account functions **745** through **755**.

Figure 7B is a sample screen showing the user-selected account functions that are available when the user is

accessing the financial institution's server using a device that communicates using a non-secure protocol from an unregistered IP address after establishing the security settings shown in **Figure 6**. Because the protocol is not 5 secured, fewer account functions are available from browser window **760** in **Figure 7B** as there were in browser window **700** shown in **Figure 7A**. Three selections, **765**, **770**, and **780**, are available as well as brokerage account functions frame **785** which includes account function **790**. The user can 10 change the security settings, shown in **Figure 6**, in order to make more or fewer selections available.

Figure 8 is a flowchart showing the steps taken to process account functions requested by the user. Processing commences at **800** whereupon a series of decisions 15 are made to determine the request that was made by the user. A determination is made as to whether the user has selected an account overview (decision **805**). If the user selected an account overview, decision **805** branches to "yes" branch **808** whereupon, at step **810** the account 20 overview function is performed.

If the user did not select an account overview, decision **805** branches to "no" branch **812** whereupon a determination is made as to whether the user has selected a funds transfer (decision **815**). If the user selected a 25 funds transfer, decision **815** branches to "yes" branch **818** whereupon, at step **820** the funds transfer function is performed.

If the user did not select an funds transfer, decision **815** branches to "no" branch **822** whereupon a determination 30 is made as to whether the user has selected online banking

(decision **825**). If the user selected online banking, decision **825** branches to "yes" branch **828** whereupon, at step **830** the online banking account function is performed.

5 If the user did not select online banking, decision **825** branches to "no" branch **832** whereupon a determination is made as to whether the user has requested to view an account statement (decision **835**). If the user has requested to view an account statement, decision **835** branches to "yes" branch **838** whereupon, at step **840** the 10 view statement account function is performed.

If the user did not request to view an account statement, decision **835** branches to "no" branch **842** whereupon a determination is made as to whether the user has requested to change his or her login identifier or 15 password (decision **845**). If the user has requested to change his or her login identifier or password, decision **845** branches to "yes" branch **848** whereupon, at step **850** the change login identifier / password account function is performed.

20 If the user did not request to change his or her login identifier or password, decision **845** branches to "no" branch **852** whereupon a determination is made as to whether the user has requested a new account (decision **855**). If the user has requested a new account, decision **855** branches 25 to "yes" branch **858** whereupon, at step **860** the request new account function is performed.

If the user did not request a new account, decision **855** branches to "no" branch **862** whereupon a determination is made as to whether the user has requested a brokerage 30 account function (decision **865**). If the user has requested

a brokerage account function, decision **865** branches to "yes" branch **868** whereupon, at step **870** the requested brokerage account function is performed.

If the user did not request brokerage services,
5 decision **865** branches to "no" branch **872** whereupon, at step **880**, the account function requested by the user is performed. After the account function requested by the user has been performed, processing returns at **895**.

Figure 9 illustrates information handling system **901** which is a simplified example of a computer system capable of performing the computing operations described herein. Computer system **901** includes processor **900** which is coupled to host bus **902**. A level two (L2) cache memory **904** is also coupled to host bus **902**. Host-to-PCI bridge **906** is coupled to main memory **908**, includes cache memory and main memory control functions, and provides bus control to handle transfers among PCI bus **910**, processor **900**, L2 cache **904**, main memory **908**, and host bus **902**. Main memory **908** is coupled to Host-to-PCI bridge **906** as well as host bus **902**.
20 Devices used solely by host processor(s) **900**, such as LAN card **930**, are coupled to PCI bus **910**. Service Processor Interface and ISA Access Pass-through **912** provides an interface between PCI bus **910** and PCI bus **914**. In this manner, PCI bus **914** is insulated from PCI bus **910**.
25 Devices, such as flash memory **918**, are coupled to PCI bus **914**. In one implementation, flash memory **918** includes BIOS code that incorporates the necessary processor executable code for a variety of low-level system functions and system boot functions.

PCI bus **914** provides an interface for a variety of devices that are shared by host processor(s) **900** and Service Processor **916** including, for example, flash memory **918**. PCI-to-ISA bridge **935** provides bus control to handle transfers between PCI bus **914** and ISA bus **940**, universal serial bus (USB) functionality **945**, power management functionality **955**, and can include other functional elements not shown, such as a real-time clock (RTC), DMA control, interrupt support, and system management bus support. Nonvolatile RAM **920** is attached to ISA Bus **940**. PCI-to-SCSI bridge **980** provides bus control to handle transfers between PCI bus **914** and SCSI bus **985**. SCSI device **990** (i.e. a SCSI hard drive) communicates with other parts of computer system **901** using SCSI bus **985**.

Service Processor **916** includes JTAG and I2C busses **922** for communication with processor(s) **900** during initialization steps. JTAG/I2C busses **922** are also coupled to L2 cache **904**, Host-to-PCI bridge **906**, and main memory **908** providing a communications path between the processor, the Service Processor, the L2 cache, the Host-to-PCI bridge, and the main memory. Service Processor **916** also has access to system power resources for powering down information handling device **901**.

Peripheral devices and input/output (I/O) devices can be attached to various interfaces (e.g., parallel interface **962**, serial interface **964**, keyboard interface **968**, and mouse interface **970** coupled to ISA bus **940**. Alternatively, many I/O devices can be accommodated by a super I/O controller (not shown) attached to ISA bus **940**.

In order to attach computer system **901** to another computer system to copy files over a network, LAN card **930** is coupled to PCI bus **910**. Similarly, to connect computer system **901** to an ISP to connect to the Internet using a 5 telephone line connection, modem **975** is connected to serial port **964** and PCI-to-ISA Bridge **935**.

While the computer system described in **Figure 9** is capable of executing the processes described herein, this computer system is simply one example of a computer system. 10 Those skilled in the art will appreciate that many other computer system designs are capable of performing the processes described herein.

One of the preferred implementations of the invention is an application, namely, a set of instructions (program 15 code) in a code module which may, for example, be resident in the random access memory of the computer. Until required by the computer, the set of instructions may be stored in another computer memory, for example, on a hard disk drive, or in removable storage such as an optical disk 20 (for eventual use in a CD ROM) or floppy disk (for eventual use in a floppy disk drive), or downloaded via the Internet or other computer network. Thus, the present invention may be implemented as a computer program product for use in a computer. In addition, although the various methods 25 described are conveniently implemented in a general purpose computer selectively activated or reconfigured by software, one of ordinary skill in the art would also recognize that such methods may be carried out in hardware, in firmware, or in more specialized apparatus constructed to perform the 30 required method steps.

While particular embodiments of the present invention have been shown and described, it will be obvious to those skilled in the art that, based upon the teachings herein, changes and modifications may be made without departing 5 from this invention and its broader aspects and, therefore, the appended claims are to encompass within their scope all such changes and modifications as are within the true spirit and scope of this invention. Furthermore, it is to be understood that the invention is solely defined by the 10 appended claims. It will be understood by those with skill in the art that if a specific number of an introduced claim element is intended, such intent will be explicitly recited in the claim, and in the absence of such recitation no such limitation is present. For a non-limiting example, as an 15 aid to understanding, the following appended claims contain usage of the introductory phrases "at least one" and "one or more" to introduce claim elements. However, the use of such phrases should not be construed to imply that the introduction of a claim element by the indefinite articles 20 "a" or "an" limits any particular claim containing such introduced claim element to inventions containing only one such element, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an"; the same holds 25 true for the use in the claims of definite articles.